PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : E04B 5/48, 5/43 — A1

(11) International Publication Number: WO 91/02859

(43) International Publication Date: 7 March 1991 (07.03.91)

(21) International Application Number: PCT/NL90/00122

(22) International Filing Date: 22 August 1990 (22.08.90)

(30) Priority data:
8902130 23 August 1989 (23.08.89) NL

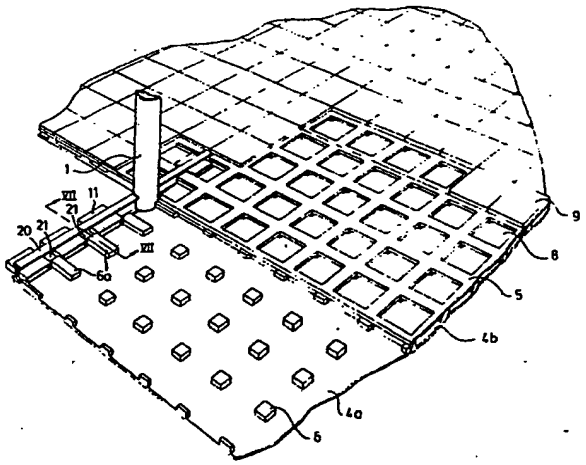
(71)(72) Applicant and Inventor: ROETERDINK, Anton, Jan [NL/NL]; Ketenbosweg 9, NL-7213 WB Gorssel (NL).

(74) Agents: DE BRUIJN, Leendert, C. et al.; Nederlandsch Octrooibureau, Scheveningseweg 82, P.O. Box 29720, NL-2502 LS The Hague (NL).

(81) Designated States: AT (European patent), AU, BB, BE (European patent), BG, BR, CA, CH (European patent), DE (European patent)*, DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, MW, NL (European patent), NO, RO, SD, SE (European patent), SU, US.

Published
With international search report.
In English translation (filed in Dutch).

(54) Title: BUILDING METHOD



(57) Abstract

In a building method columns (1) are placed in a rectangular grid arrangement, horizontal supporting elements (3; 20) are fixed to said columns, and concrete floors which are supported by said supporting elements are placed. In order to increase building speed and to allow facilities such as ventilation ducts, electricity cables and computer cables to be accommodated in the concrete floor instead of underneath it, said supporting elements (3; 20) form a system of girders, each provided with a number of adjacent, spaced feed-through conduits (11), the floors are made of prefabricated hollow floor elements, each with a bottom sheet (4), a top sheet (5) and spacers (6, 6a) arranged in a grid-shape placed between them, the bottom sheet (4) of each floor element having at two opposite sides laterally projecting parts (4a) and, in order to fix the floor elements, they are raised until the projecting parts (4a) lie against the girders (3; 20), following which said projecting parts are connected to the girders.

* See back of page

DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MC	Monaco
AU	Australia	FI	Finland	MG	Madagascar
BB	Barbados	FR	France	ML	Mali
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GR	Greece	NL	Netherlands
BJ	Benin	HU	Hungary	NO	Norway
BR	Brazil	IT	Italy	PL	Poland
CA	Canada	JP	Japan	RO	Romania
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo			SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CM	Cameroon	LI	Liechtenstein	SU	Soviet Union
DE	Germany	LK	Sri Lanka	TD	Chad
DK	Denmark	LU	Luxembourg	TG	Togo
				US	United States of America

Title: Building method.

The invention relates to a building method, comprising placing columns in a rectangular grid arrangement, fixing to said columns horizontal supporting elements, and placing concrete floors which are supported by said supporting elements.

Such a method was devised by Geilinger A.G. in Switzerland. This firm described the building system in question in leaflets and acquired European Patent No. 0044271 for details of the system. In general, the columns are made of steel, although concrete columns are not ruled out. According to the known building system, the concrete floors are poured on the spot and supported on crowns fixed to the columns. Either ordinary wooden forms or prefabricated forms approximately 5 cm thick are fixed below the crowns here. The floor formwork is supported by means of yokes which bear on the set floor underneath them. A floor approximately 22 to 27 cm thick is poured on the skins. The major disadvantages of this system are:

that setting and supporting of the concrete floors takes so much time that building speed is lower than the speed corresponding to erecting the steel structure;

that facilities such as ventilation ducts, electricity cables and computer cables have to be accommodated in separate spaces under the concrete floor, so that the total thickness of floor and facility space is great, and the height of the storey is also consequently great;

that pouring concrete floors on the spot is unpopular, dirty work;

that when there is heavy rain and/or frost no concrete can be poured.

The object of the invention is to avoid these disadvantages, and to this end the building method mentioned in the preamble is characterized in that the above-mentioned supporting elements form a system of girders each provided with a number of adjacent, spaced feed-through conduits, in that the floors are made of prefabricated hollow floor elements, each having a bottom sheet, a top sheet and spacers arranged in a grid shape placed between them, the bottom sheet of each floor element having at two opposite sides laterially

projections parts,

and in that in order to fix the floor elements, they are raised until the above-mentioned projecting parts lie against the girders, following which said projecting parts are connected to the girders.

The feed-through conduits are used for feeding through lines and cables.

The floor elements are rectangular and are fixed solely by their short sides to the girders.

If the girders are steel section beams, they will have to (and/or can) be protected against fire. In a preferred building method the rows of spacers adjacent to the projecting parts project between the feed-through conduits of the girders, while concrete is poured in the spaces bounded by the external surface of the feed-through conduits and the end faces of the spacers projecting between the feed-through conduits.

An excellent connection between the floor elements and the girders is obtained through the end faces of the spacers projecting between the feed-through conduits being made step-shaped in such a way that the space between two opposite spacers widens out step-shaped from top to bottom.

The girders are preferably steel I beams.

The steel beams can also be channel beams, in which case a reinforced concrete is placed in the channel beam.

In the case of relatively high floors, the beams can comprise two tilted channel beams held apart by transverse conduits, and the space between said beams is filled with concrete.

It is important that the reinforcement of the concrete floor elements should not be prestressed. This avoids concave or convex surfaces of the floors.

In order to ensure that the hollow between the top and bottom sheet of the floor elements can be reached easily, the top sheet is provided with apertures which are placed in a grid arrangement and can be covered with tile-type sheets abutting each other.

The invention will now be explained in greater detail with

reference to the figures, in which three examples of embodiments are shown.

Figure 1 shows a perspective view of a part of a structure built according to the invention, for the sake of clarity parts of some floor elements being shown partially cut away.

Figure 2 is a section along the line II-II in Figure 1.

Figure 3 is a section along the line III-III in Fig. 1.

Figure 4 is a section along the line IV-IV in Figure 1.

Figure 5 shows a section comparable to that of Figure 4 of an alternative girder design.

Figure 6 shows a perspective view of a structure in which the preferred method according to the invention is used.

Figure 7 shows a section along the line VII-VII in Figure 6.

The structure shown comprises a number of columns 1, preferably of steel, placed in a rectangular grid arrangement. At each column a number of crowns 2 are placed above one another. The vertical distance between the crowns corresponds to the height of storey. Since such a system is known per se, only one column with one crown is shown in Figure 1.

The invention is concerned with the way in which prefabricated floor elements are supported relative to the columns 1. The prefabricated floor elements are of dimensions of, for example, 720 x 240 cm.

In the invention according to Figures 1 - 4, girders in the form of steel channel beams 3 are fixed between the crowns 2 situated at the same level. These beams run parallel to each other, and their lengthwise direction coincides with the direction of the transverse edges of the prefabricated concrete floor elements which are fixed to the channel beams and will be described in greater detail below.

Each floor element comprises a bottom sheet 4, a top sheet 5, and fitted between said sheets spacers 6 in the form of lobes which are moulded onto the bottom face of the top sheet and are in a grid arrangement.

The bottom sheet 4 is anchored to the lobes 6 through reinforcement ties 7 being concreted into the lobes and projecting at the bottom side, and being forced into the concrete of the

bottom sheet before this concrete is set.

Figure 1 shows the bottom sheet 4 of a first floor element without top sheet and the bottom sheet 4 with top sheet 5 of the second floor element. The top sheet is provided with apertures 8 placed in a grid arrangement and covered with tile-shaped sheets 9.

It can be seen from Figure 4 that the top sheets 5 at the transverse edges of the floor elements abut one leg of a channel beam 3, while the bottom sheets 4 at their transverse edges project under the body of a channel beam 4 at 4a up to the transverse edge of the bottom sheet 4 of another floor element.

When being fitted, the floor elements are raised until the projecting parts 4a rest against the girders 20.

These parts 4a of the bottom sheet lying under the body of a channel beam are fixed to the body by means of bolts. The bolts are shown schematically in Figure 4 by dotted and dashed lines 10.

At the position of each crown 2, a recess is provided in the corners of a floor element, into which recess a part of the crown fits.

The channel beams 3 are provided with transverse feed-through conduits 11 which open out into apertures 12 in the legs of the beams 3, and which serve to carry lines or cables from a hollow space of one floor element through the channel beams 3 to the hollow space of another floor element.

Reinforced concrete is poured into the channel beams, so that the channel beams serve as permanent falsework. If the channel beams are destroyed by fire, the concrete remains in place.

The embodiment shown in Figure 5 is intended for higher floors. Instead of a channel beam 3, use is made of two channel beams 13 which are tilted through 90°, and between which transverse conduits 11 are welded, which conduits open out into openings in the body of the channel beams 13. Lock-woven mesh is placed in the space between the channel beams 13 and concrete is poured. The top sheets 5 are provided at their transverse edges with projecting reinforcement irons 14, the projecting part of which is embedded in the concrete between the channel beams 13.

In the case of the building method illustrated in Figures 6 and 7, the girders are in the form of I beams 20 which are fixed to the columns 1 without crowns between them. The hollow floor elements, comprising a bottom sheet 4, a top sheet 5, and spacers 6 placed in a grid arrangement between said sheets are fixed at their transverse end edges to the I beams 20 through the projecting parts 4a of the bottom sheet 4 being engaged with the bottom flange of the I beams and fixed by bolts 10 when the floor elements are raised.

The rows of spacers 6a adjacent to the projecting bottom sheet parts 4a are made elongated and project between the feed-through conduits 11. Concrete is poured into the spaces 21 bounded by the outer surface of the feed-through conduits and the end faces 6b of the spacers 6, so that the I beams 20 and the conduits 11 are completely embedded in concrete. This greatly improves fire safety.

Because the end faces 6b of the spacers 6a are made step-shaped in such a way that the space between two opposite spacers 6a widens out downwards in a step shape, an excellent connection is also produced between the spacers 6a and the girders 20.

The seams between the bottom sheets 4 of the floor elements are sealed with a sealer or shaped metal strip.

All kinds of facilities, including those in the field of heating, ventilation, electricity, telephone, computers, can be accommodated in the hollow floor elements, so that a separate space for these underneath the floor is not necessary. The storey height of a building can be limited as a result of this. After the fitting of a floor, it is possible to start immediately on the fitting of the next floor, which means that building can be speeded up considerably compared with a building system in which the floors are poured on the spot. It is possible to work immediately on each fitted floor, since there is no need to wait for setting and there are no supports on it for the next floor. If there are steel columns, they are enclosed with fire-resistant material.

Claims

1. Building method, comprising placing columns (1) in a rectangular grid arrangement, fixing to said columns horizontal supporting elements (3; 20), and placing concrete floors which are supported by said supporting elements (3; 20), characterized in that
the above-mentioned supporting elements form a system of girders each provided with a number of adjacent, spaced feed-through conduits (11),
the floors are made of prefabricated hollow floor elements, each having a bottom sheet (4), a top sheet (5) and spacers (6, 6a) arranged in a grid shape placed between them, the bottom sheet (4) of each floor element having at two opposite sides laterally projecting parts (4a),
and, in order to fix the floor elements, they are raised until said projecting parts (4a) lie against the girders (3; 20), following which said projecting parts are connected to the girders.

2. Building method according to Claim 1, characterized in that the floor elements are rectangular and are fixed solely by their short sides to the girders (3; 20).

3. Building method according to Claim 1 or 2, characterized in that the rows of spacers (6a) adjacent to the projecting parts (4a) project between the feed-through conduits (11) of the girders (20), and in that concrete is poured in the spaces (21), bounded by the external surface of the feed-through conduits (11) and the end faces (6b) of the spacers (6a) projecting between the feed-through conduits (11).

4. Building method according to Claim 3, characterized in that the above-mentioned end faces (6b) of the spacers (6a) projecting between the feed-through conduits (11) are made step-shaped in such a way that the space between two opposite spacers widens out step-shaped from top to bottom.

5. Building method according to any of the preceding claims, characterized in that the girders are steel I beams (20).

6. Building method according to Claim 1, characterized in

that the steel beams (3) are channel beams, and in that reinforced concrete is placed in the channel beams.

7. Building method according to Claim 1, characterized in that the steel beams comprise two tilted channel beams (13) held apart by transverse conduits, and the space between said beams is filled with concrete.

8. Building method according to any of the preceding claims, characterized in that the reinforcement of the concrete floor elements is not prestressed.

9. Building method according to any of the preceding claims, characterized in that the top sheet (4) of each floor element is provided with apertures (8) placed in a grid arrangement, which apertures are covered with tile-shaped sheets (9) abutting each other.

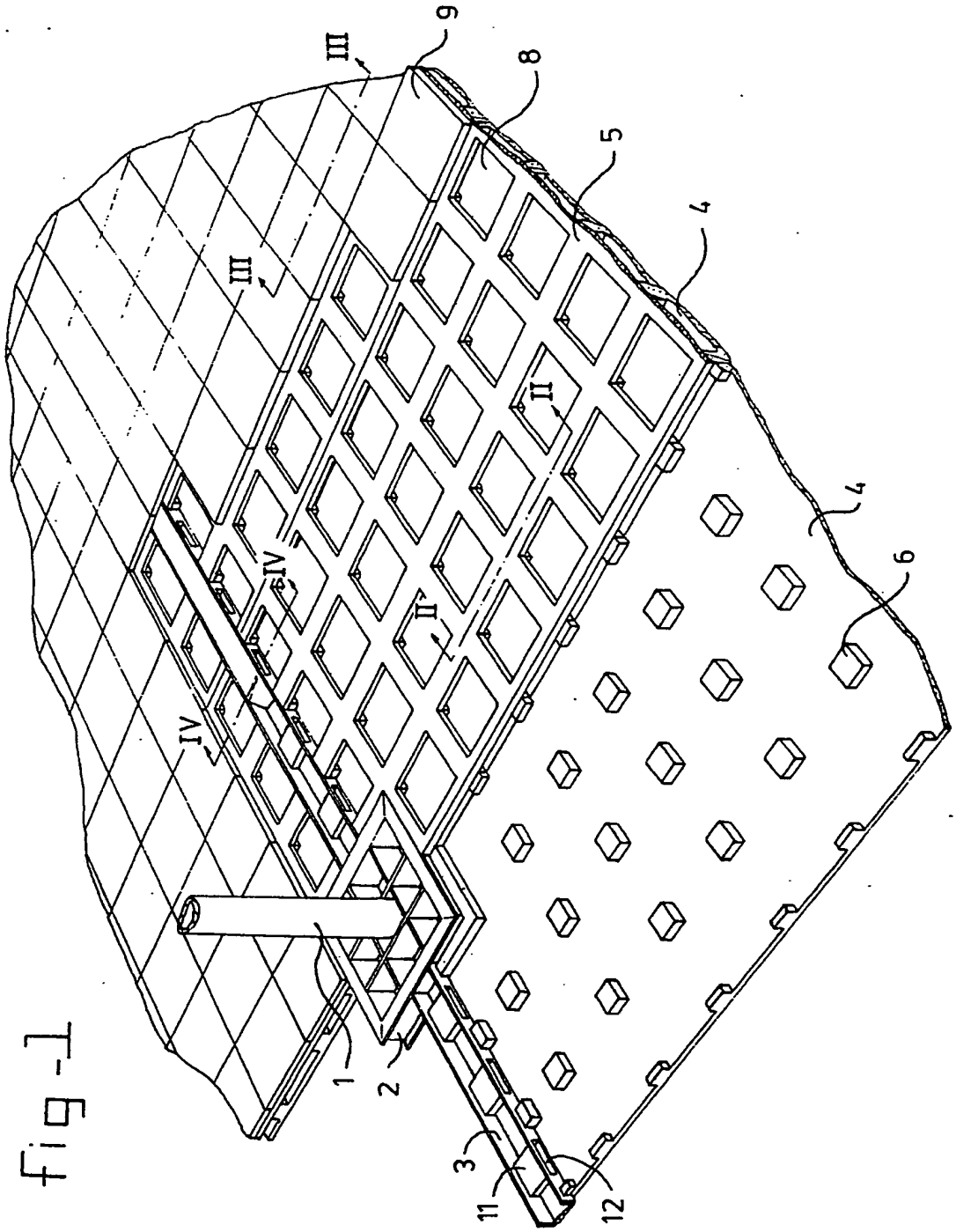


Fig-1

Fig-2

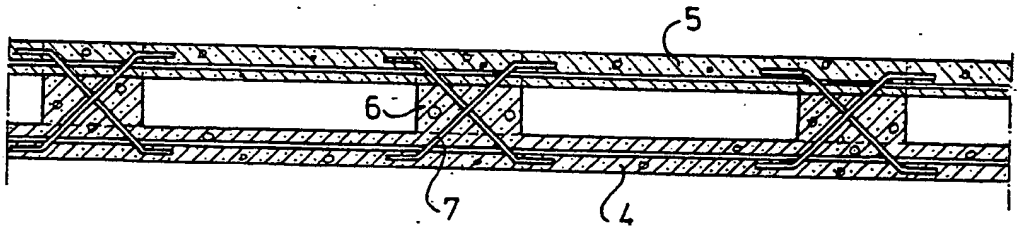


Fig-3

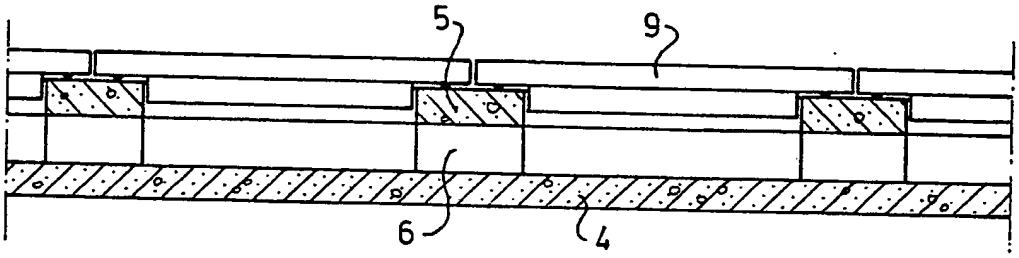


Fig-4

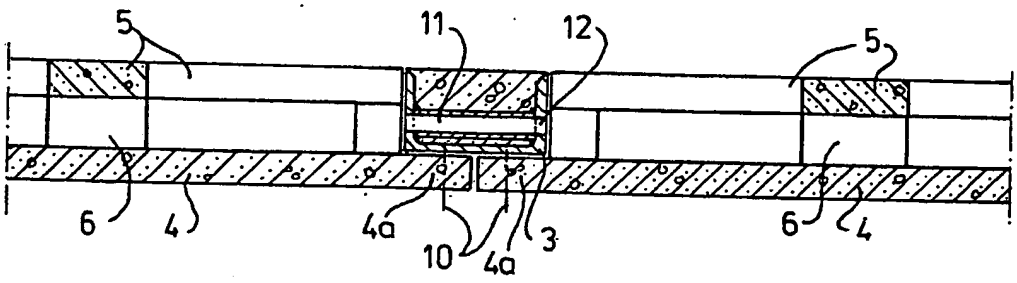
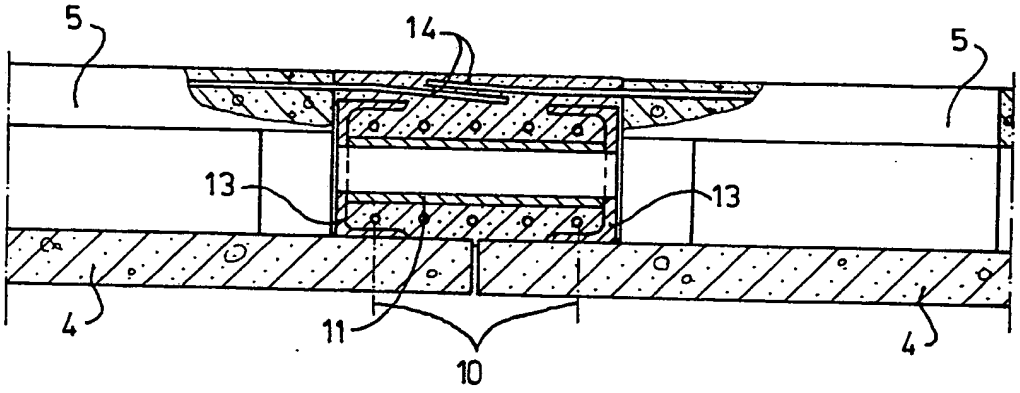


Fig-5



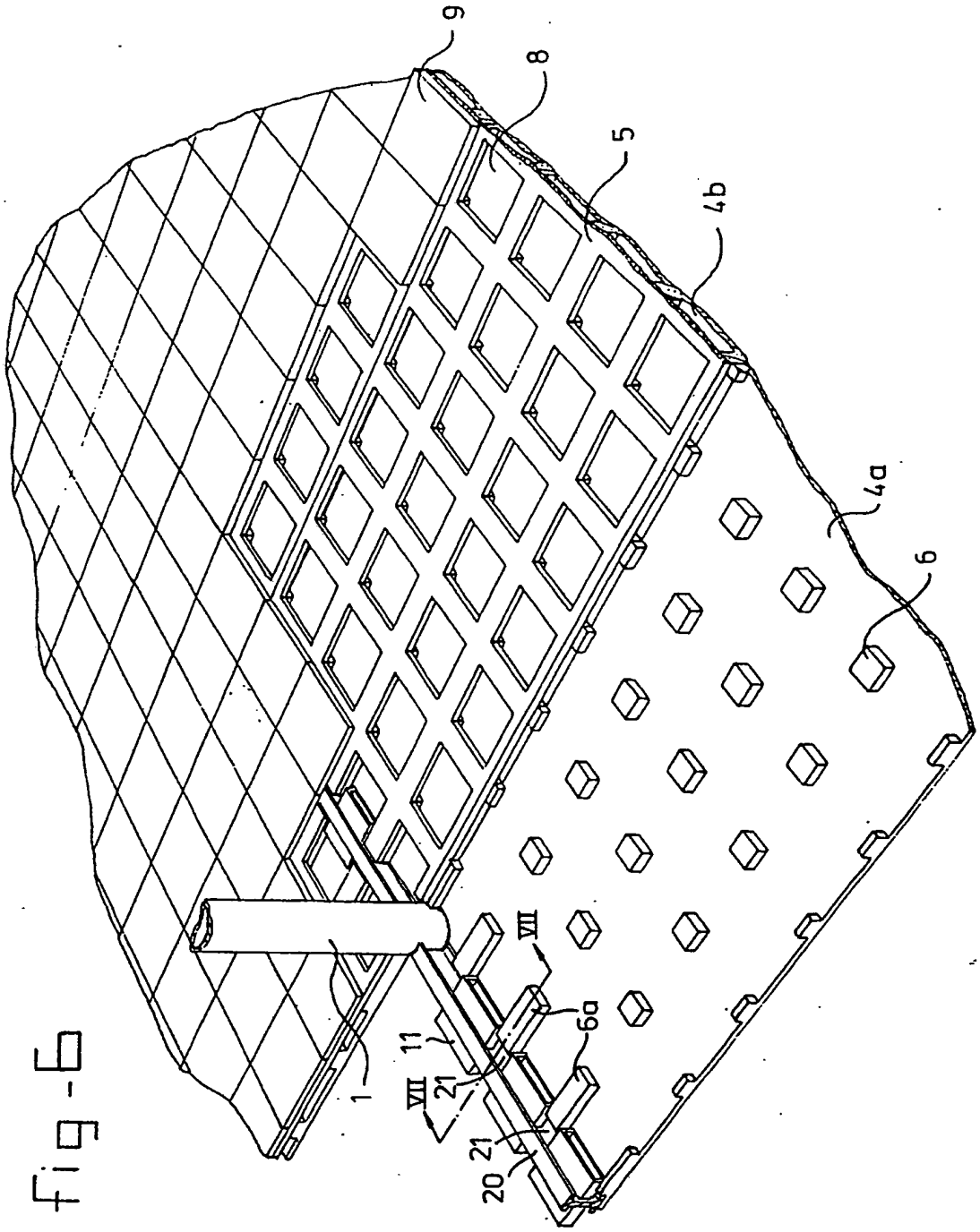
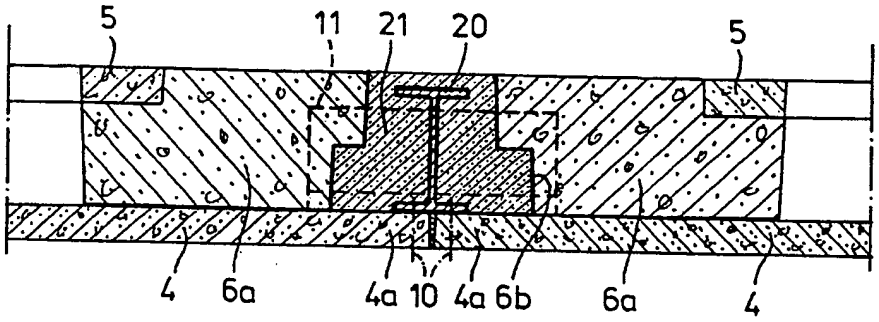


Fig-6

Fig-7



INTERNATIONAL SEARCH REPORT

International Application No PCT/NL 90/00122

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: E 04 B 5/48, E 04 B 5/43

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	E 04 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	DE, A, 2324224 (SILBERKUHL) 5 December 1974 see page 7, paragraphs 4,5; page 8; figures 1-6	1,2,8
A	--	9
Y	FR, A, 2142887 (ORTMANN) 2 February 1973 page 5, lines 32-34; page 8, lines 13-25; page 12, lines 5-8; page 14, lines 9-39; page 15; page 16, lines 1-4; figures 1,2,3,4,7,30,32,43	1,2,8
A	-- US, A, 4333285 (HAJIME KOIZUMI) 8 June 1982 see column 3, lines 33-51; column 5, lines 15-32; figures 1,2,6,16,24,25,26, 27	5,6,7
	-- ./.	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
31st October 1990	20. 11. 90
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	miss T. MORTENSEN

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	DE, B, 1250998 (DEILMANN) 28 September 1967 see column 4, lines 60-65; figures 8,9 --	9
A	DE, A, 3309820 (AINEDTER) 20 September 1984 see page 19, lines 12-30; page 20, lines 1-12; page 22, lines 10-15; figures 10,11,12,13 --	1
A	EP, A, 0104262 (RUFFER) 4 April 1984 see figures 1,2,3,9 --	1
A	AU, A, 509705 (ELSPAN INTERNATIONAL) 20 July 1978 ----	

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. NL 9000122
SA 39297

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 14/11/90
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 2324224	05-12-74	None	
FR-A- 2142887	02-02-73	None	
US-A- 4333285	08-06-82	JP-A- 53090612	09-08-78
		JP-A,B,C53114214	05-10-78
		US-A- 4211045	08-07-80
DE-B- 1250998		None	
DE-A- 3309820	20-09-84	None	
EP-A- 0104262	04-04-84	None	
AU-A- 509705	22-05-80	None	